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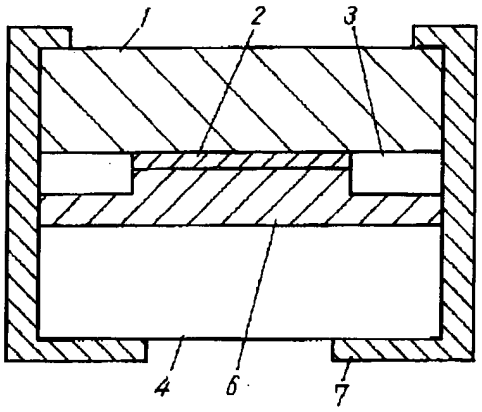
(54) **CHIP-SHAPED MAGNETIC SENSOR ELEMENT AND ITS MANUFACTURE**

(57) Abstract:

PROBLEM TO BE SOLVED: To obtain a chip-shaped magnetic sensor element which enhances a detection output by a method wherein a magnetism detecting film and a deviation electrode part are arranged inside the bonding face of a takeout substrate to a support substrate and both end faces of both substrates are provided with end-face electrodes which are connected electrically.

SOLUTION: First, a magnetism detecting film 2 and many electrode parts 3 are formed on a support substrate 1 directly by a vapor deposition operation or the like or by a transfer operation or the like. Then, a takeout substrate 4 whose size is nearly equal to that of the substrate 1 is bonded via a bonding layer 6 made of a thermosetting resin or the like in such a way that the detecting film 2 and the electrode parts 3 are sandwiched. After that, it is separated to be a rod shape by a dicing operation or the like in such a way that the electrode parts 3 are exposed to side faces. Then, side-face electrodes 7 are formed over both end faces of the substrate 1 and the substrate 4 by a printing operation, a dipping operation or the like, and they are connected electrically inside film-thickness faces of the electrode parts 3. After that, individual elements are separated by a dicing operation or the like. The thickness of a chip- shaped magnetic sensor element which is formed in this manner can be formed to be thin, and its detection output can be increased.





10-227845

* NOTICES *



side electrodes

various sub. ceramics, Si

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the tipped type magnetometric-sensor element used for field indicators, such as a rotated type, and its manufacture method.
[0002]
[Description of the Prior Art] A semiconductor thin film magnetometric-sensor element uses the property in which generating and the resistance of voltage change, when carrier mobility, such as InSb, InSb-NiSb, and InAs, makes a magnetic field act to a high semiconductor.
[0003] The structure of the field indicator using the semiconductor thin film magnetometric-sensor element general to drawing 4 is shown. 33 is a connector block which consists of an insulating material, and this connector block 33 has the circuit section 35 by which the aforementioned magnetometric-sensor element 38 was electrically connected to the magnet 37 for bias mechanically fixed to the edge of one of these, and the aforementioned magnet 37 for bias through the magnetometric-sensor element 38 attached mechanically and the relay terminal 36 prepared in the aforementioned electrode holder 34. And it is mechanically fixed to the flange 32 of the aforementioned electrode holder 34, and has the structure of having the cap 31 who protects these magnetometric-sensor elements 38 and circuit section 35 grade.
[0004] The cross section to which the ejection composition of the interior of the aforementioned cap 31 and the electrical signal of the magnetometric-sensor element 38 was expanded further is shown in drawing 5 .
[0005] It is-izing and formed. the magnetometric-sensor element 38 shown in drawing 4 -- ********** -- As shown in drawing 5 , in order to take out an electrical signal from the magnetic detection film 42 and the aforementioned magnetic detection film 42 on the support substrate 41, the polar zone 43 is formed. Die bond of the support substrate 41 in which the aforementioned magnetic detection film 42 and the polar zone 43 were formed is carried out to a leadframe 45. While connecting with a leadframe 45 using the wire 44 of wire bonding from the aforementioned polar zone 43, it is the composition by which transfermold was carried out by the resin 46 so that a part of aforementioned support substrate 41 and wire 44, and aforementioned leadframe 45 might be wrapped in. And this magnetometric-sensor element 38 is made to fix mechanically on the magnet 37 for bias.
[0006] Moreover, the air gap (space) 47 was formed between the magnetometric-sensor element 38 and the cap 31, and generating (it will be called a piezo noise from now on) of the noise by stress distortion when stress joins the magnetic detection film 42 which is in the aforementioned magnetometric-sensor element 38 by deformation of a cap 31 is prevented.
[0007] Next, operation of a general field indicator is explained based on drawing 6 . If the rotating magnetic substance 49 with salient 49a approaches at a cap's 31 nose of cam as shown in drawing 6 , on both sides of the aforementioned magnetometric-sensor element 38, a magnetic path will be formed between the aforementioned magnets 37 for bias. Since the flux density which joins the aforementioned magnetometric-sensor element 38 with the relative position of the aforementioned salient 49a and the aforementioned magnet 37 for bias changes, the change is changed into an electrical signal, is processed by the aforementioned circuit section 35, and is taken out as an output signal.
[0008]
[Problem(s) to be Solved by the Invention] In said field indicator, a big output is obtained, so that the distance of the aforementioned magnetic substance 49 and the aforementioned magnet 37 for bias is small. Here, distance consists of four space called the air gap 47 (the 3rd space) with the magnetometric-sensor element 38 by which the package was carried out aforementioned ] with the aforementioned magnetic substance 49, and the thickness (the 2nd space) of between the aforementioned caps 31 (the 1st space) and a cap 31 and a cap 31, and the thickness of the magnetometric-sensor element 38.
[0009] Recently, from a user, there is a request which wants to extend the space of a between further with the magnetic substance 49 and the cap 31 who are the 1st space because of the simplification of the installation field of a field indicator, and, for that, the detection output of a field indicator must be heightened. In order to heighten a detection output, it is necessary to bring the magnetic substance 49 and the aforementioned magnet 37 for bias close as much as possible. Moreover, although it is necessary to constitute the 4th space from the 2nd space narrowly, the 2nd space is a cap's 31 thickness and is not made not much thinly in respect of intensity. Moreover, the 3rd space is the air gap 47 for a piezo noise cure similarly, and cannot be made not much thin.
[0010] Moreover, although basis board thickness of the support substrate 41 which forms the magnetic detection film 42 can be made thin in polish etc. as a method of making thin thickness of the package-ized magnetometric-sensor element 38, it

cannot do not much thinly from the handling of a substrate etc.
[0011] this invention aims at the detection output of a field indicator improving.
[0012]
[Means for Solving the Problem] In order to solve this technical problem, the tipped type magnetometric-sensor element of this invention comes to join a support substrate with a magnetic detection film on the field of one of these of an ejection substrate, and the aforementioned magnetic detection film is arranged in the plane of composition of the aforementioned ejection substrate and the aforementioned support substrate, and is equipped with the side electrode which connected with the drawer polar zone electrically from the aforementioned magnetic detection film at least in the ends side of the aforementioned ejection substrate.
[0013] It is not necessary to form by this the transfermold which wraps in the drawing wire of the electrical signal from a magnetic detection film and a magnetic detection film, and a leadframe, for this reason, the thickness of a tipped type magnetometric-sensor element can be formed thinly, and the detection output of a field indicator improves.
[0014]
[Embodiments of the Invention] The support substrate which has the drawer polar zone of the magnetic detection film concerned while invention of this invention according to claim 1 has a magnetic detection film on one field, The ejection substrate which was joined to the above-mentioned support substrate and arranged the above-mentioned magnetic detection film in the joint, It is the tipped type magnetometric-sensor element equipped with the side electrode which it was prepared at least in the ends side of the above-mentioned ejection substrate, and was prepared in the above-mentioned support substrate and which pulled out and was electrically connected to the polar zone. Since it can do by not forming the transfermold which wraps in the drawing wire of the electrical signal from a magnetic detection film and a magnetic detection film, and a leadframe, the thickness of a sensor element can be formed thinly and it has operation that the detection output of a field indicator improves.
[0015] Invention of this invention according to claim 2 is the tipped type magnetometric-sensor element according to claim 1 which formed the aforementioned magnetic detection film in the support substrate directly, since it is possible by not forming the transfermold which wraps in the drawing wire of the electrical signal from a magnetic detection film and a magnetic detection film, and a leadframe, can form the thickness of a sensor element thinly and has operation that the detection output of a field indicator improves.
[0016] Invention of this invention according to claim 3 is the tipped type magnetometric-sensor element according to claim 1 which carried out imprint formation of the aforementioned magnetic detection film at the support substrate, and since it can do by not forming the transfermold which wraps in the drawing wire of the electrical signal from a magnetic detection film and a magnetic detection film, and a leadframe, the thickness of a sensor element can be formed thinly and it has operation that the detection output of a field indicator improves.
[0017] Invention of this invention according to claim 4 is a tipped type magnetometric-sensor element according to claim 1 using any one which chose the support substrate from Si, ceramics, sapphire, and the ferrite, and has operation that it is utilizable as a support substrate.
[0018] Invention of this invention according to claim 5 is a tipped type magnetometric-sensor element according to claim 1 using any one which chose the aforementioned ejection substrate from charges of an insulation machine plate, such as ceramics, a ferrite, and glass, and has operation that it is utilizable as an ejection substrate.
[0019] Invention of this invention according to claim 6 takes out by making the same material which is the tipped type magnetometric-sensor element according to claim 1 which constituted the aforementioned ejection substrate and the aforementioned support substrate from same material, and is put, loses the expansion differential shrinkage by junction of a substrate and a support substrate, and has operation of preventing the stress distortion by the magnetic detection film put between the aforementioned substrates.
[0020] Invention of this invention according to claim 7 has gone across and prepared the aforementioned side electrode in the ends side of both the aforementioned ejection substrate and the aforementioned support substrate joined mutually, and it is the tipped type magnetometric-sensor element according to claim 1 which connected electrically into the thickness side of the electrode pulled out by the aforementioned ends side from the aforementioned magnetic detection film, and it has operation that composition is easy and SMD mounting of lead loess can perform.
[0021] the hole with which invention of this invention according to claim 8 arranged the aforementioned side electrode in the position corresponding to the aforementioned drawer electrode of the aforementioned support substrate of the aforementioned ejection substrate -- it is the tipped type magnetometric-sensor element according to claim 1 which constituted so that it might connect with the above-mentioned drawer polar zone electrically, and it has operation that composition is easy and SMD mounting of lead loess can perform, including the electrode material prepared inside
[0022] The process at which invention of this invention according to claim 9 forms the drawer polar zone which takes out the electric signal from a magnetic detection film and the aforementioned magnetic detection film on a support substrate, The process which takes out so that the forming face of the aforementioned magnetic detection film may be inserted to the aforementioned support substrate, and joins a substrate, It is the manufacture method of the tipped type magnetometric-sensor element equipped with the process which forms a side electrode so that it may connect electrically into the thickness side of the polar zone which crossed to the ends side of both the aforementioned ejection substrate and the aforementioned support substrate, and was pulled out by the aforementioned ends side from the aforementioned magnetic detection film. Almost can be created by batch processing, such as a wafer which forms many elements simultaneously, and it has operation of moreover

enabling SMD mounting of lead loess according to an easy process.
[0023] The process at which invention of this invention according to claim 10 forms the drawer polar zone which takes out the electric signal from a magnetic detection film and the aforementioned magnetic detection film on a support substrate, The process which arranged the hole in the position corresponding to the aforementioned drawer polar zone and which takes out, and joins a substrate so that the forming face of the aforementioned magnetic detection film may be inserted to the aforementioned support substrate, It is the manufacture method of the tipped type magnetometric-sensor element equipped with the process which prepares electrode material inside and forms a side electrode only in the ends side of the above-mentioned ejection substrate. it connects with the aforementioned drawer polar zone electrically -- as -- the hole of the aforementioned ejection substrate -- It can create by batch processing, such as a wafer which forms the element of all process large number simultaneously, and has operation of moreover enabling SMD mounting of lead loess according to an easy process.
[0024] Hereafter, the gestalt of operation of this invention is explained using drawing 3 from drawing 1 .
(Gestalt 1 of operation) Drawing 1 shows the 1st operation gestalt of the tipped type magnetometric-sensor element of this invention. In drawing, 1 is a magnetic detection film with which support substrates, such as Si, ceramics, sapphire, and a ferrite, and 2 consist of ferromagnetics, such as a semiconductor with high carrier mobility, such as InSb, InSb-NiSb, and InAs, or nickel-Co, nickel-Fe, and nickel-Fe-Co, and it is formed by direct or the imprint by vacuum evaporationo etc. on the aforementioned support substrate 1. 3 is the ejection polar zone of the electrical signal from the aforementioned magnetic detection film 2 which consists of material, such as Au/nickel, aluminum/Cr, Cu/Ti, Cu/Cr, and In, Pb, and is formed to the ends of the aforementioned support substrate 1 by vacuum evaporationo etc. on the aforementioned support substrate 1 like the aforementioned magnetic detection film 2. 4 became, was taken out from insulating materials, such as ceramics, a ferrite, and glass, and it is a substrate, and it is joined to the aforementioned support substrate 1 through a glue line 6 so that the aforementioned magnetic detection film 2 and the polar zone 3 may be put. 7 is a side electrode which consists of material gone across and prepared in the ends side of both the aforementioned ejection substrate and the aforementioned support substrate joined mutually, such as solder, and Cu, nickel, Ag, Au, Pb, Pt, and is electrically connected into the thickness side of the polar zone 3 pulled out by the aforementioned ends side from the aforementioned magnetic detection film 2.
[0025] In addition, it will take out, if the aforementioned ejection substrate 4 and the aforementioned support substrate 1 are constituted from same material, and the expansion differential shrinkage by junction of a substrate 4 and the support substrate 1 is lost, non-stress-ization of the stress distortion by the magnetic detection film 2 put between the aforementioned substrates is obtained, and magnetic-properties sensitivity improves.
[0026] The creation method of a tipped type magnetometric-sensor element joins the support substrate 1 and the aforementioned ejection substrate 4 of the size about equivalent which formed many for the aforementioned magnetic detection film 2 and the polar zone 3 on the support substrate 1 by direct or the imprint by vacuum evaporationo etc., and formed many aforementioned magnetic detection films 2 and polar zone 3 through the glue lines 6, such as a hardenability resin and an anisotropy resin, to the aforementioned support substrate 1 so that the aforementioned magnetic detection film 2 and the polar zone 3 may be put. Then, after dissociating cylindrically by dicing etc. so that the polar zone 3 formed in the both sides of the aforementioned magnetic detection film 2 may express on the side, it takes out with the aforementioned support substrate 1, it crosses to the ends side of both substrates 4, and connects electrically into the thickness side of the polar zone 3 which formed by printing, the DIP, etc. and was pulled out by the aforementioned ends side from the aforementioned magnetic detection film 2. Then, it separates into an individual element by dicing etc.
[0027] In addition, after individual separation takes out with the aforementioned support substrate 1 and joins a substrate 4, it may be performed, and you may form a side electrode by the barrel plating etc. after that.
[0028] Moreover, if it carries out after joining the support substrate 1 and the aforementioned ejection substrate 4, since it will become the structure which basis board thickness took out and added the substrate, the process which makes still thinner basis board thickness of the support substrate 1 in which the magnetic detection film 2 was formed, by polish etc. can be ground more thinly than the conventional support substrate that it is hard to generate handling and camber of a substrate.
[0029] The support substrate 1 is still also still thinner than before, and the tipped type magnetometric-sensor element created by this example is made while it is thin by mould thickness compared with the package-ized conventional magnetometric-sensor element and being able to form it. For this reason, the result which the detection output of a field indicator raised 20 to 30% was obtained.
[0030] (Gestalt 2 of operation) Drawing 2 is the cross section showing the 2nd 1 operation gestalt of the tipped type magnetometric-sensor element of this invention. In drawing 2 , 1 is a magnetic detection film with which support substrates, such as Si, ceramics, sapphire, and a ferrite, and 2 consist of ferromagnetics, such as a semiconductor with high carrier mobility, such as InSb, InSb-NiSb, and InAs, or nickel-Co, nickel-Fe, and nickel-Fe-Co, and it is formed by direct or the imprint by vacuum evaporationo etc. on the aforementioned support substrate 1. 3 is the ejection polar zone of the electrical signal from the aforementioned magnetic detection film 2 which consists of material, such as Au/nickel, aluminum/Cr, Cu/Ti, Cu/Cr, and In, Pb, and is formed to the ends or the ends this side of the aforementioned support substrate 1 by vacuum evaporationo etc. on the aforementioned support substrate 1 like the aforementioned magnetic detection film 2. 4 became, was taken out from insulating materials, such as ceramics, a ferrite, and glass, and it is a substrate, and it is joined to the aforementioned support substrate 1 through a glue line 6 so that the aforementioned magnetic detection film 2 and the polar zone 3 may be put.
[0031] The hole arranged in the position corresponding to the both sides of the ejection polar zone 3 of the electrical signal

from the aforementioned magnetic detection film 2 formed on the aforementioned support substrate 1 is prepared in the aforementioned ejection substrate 4.

[0032] In addition, it will take out, if the aforementioned ejection substrate 4 and the aforementioned support substrate 1 are constituted from same material, and the expansion differential shrinkage by junction of a substrate 4 and the support substrate 1 is lost, non-stress-ization of the stress distortion by the magnetic detection film 2 put between the aforementioned substrates is obtained, and magnetic-properties sensitivity improves.

[0033] 7 -- the hole of the aforementioned ejection substrate 4 -- it is the side electrode which consists of material prepared inside, such as solder, and Cu, nickel, Ag, Au, Pb, Pt, and connects with the ejection polar zone 3 of the electrical signal from the aforementioned magnetic detection film 2 formed on the aforementioned support substrate 1 electrically

[0034] The creation method of the tipped type magnetometric-sensor element of the 2nd operation gestalt-Many is formed for the aforementioned magnetic detection film 2 and the polar zone 3 on the support substrate 1 by direct or imprint by vacuum evaporationo etc. The support substrate 1 and the aforementioned ejection substrate 4 of the size about equivalent in which many aforementioned magnetic detection films 2 and polar zone 3 were formed are joined to the aforementioned support substrate 1 through the glue lines 6, such as a hardenability resin and an anisotropy resin, so that the aforementioned magnetic detection film 2 and the polar zone 3 may be put.

[0035] The aforementioned ejection substrate 4 has prepared many holes arranged in the position corresponding to the both sides of the ejection polar zone 3 of the electrical signal from the aforementioned magnetic detection film 2 formed on the aforementioned support substrate 1 as described above like the aforementioned support substrate 1. the above -- a hole -- the ejection of a contiguity element -- it may serve with a hole, you may form and there is an advantage which can do element size small by serving

[0036] Then, it connects with the ejection polar zone 3 of the electrical signal from the aforementioned magnetic detection film 2 which formed the side electrode 7 in the hole formed in the aforementioned ejection substrate 4 by pouring of printing, a dispenser, etc., and was formed on the aforementioned support substrate 1 electrically. Then, dicing etc. separates individually the element which carried out batch processing until now and were formed.

[0037] (Gestalt 3 of operation) it is shown in drawing 3 -- as -- the above -- a hole -- the hole of the with ejection substrate 4 -- if the ground electrode 5 of the side electrode 7 is beforehand formed inside, side electrode 7 formation will be simplified -- having -- the side electrode 7 -- a hole -- what is necessary is for there to be no need of burying all inside and just to form in the polar zone 3 and the ground electrode 5

[0038] Moreover, if it carries out after joining the support substrate 1 and the aforementioned ejection substrate 4, since it will become the structure which basis board thickness took out and added the substrate, the process which makes still thinner basis board thickness of the support substrate 1 in which the magnetic detection film 2 was formed, by polish etc. can be ground more thinly than the conventional support substrate that it is hard to generate handling and camber of a substrate.

[0039]

[Effect of the Invention] The support substrate 1 is still also still thinner than before, and the tipped type magnetometric-sensor element of this invention is made while it is thin by mould thickness compared with the package-ized conventional magnetometric-sensor element and being able to form it. For this reason, the result which the detection output of a field indicator raised 20 to 30% was obtained.

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[Translation done.]

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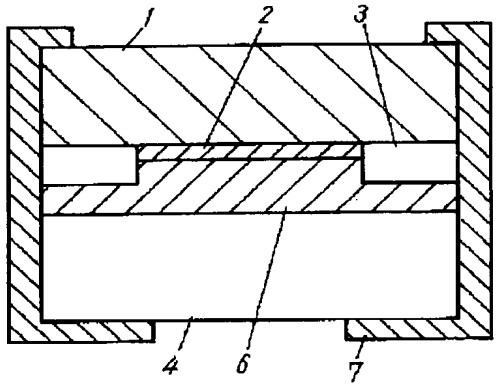
(54) **CHIP-SHAPED MAGNETIC SENSOR ELEMENT AND ITS MANUFACTURE**

(57) Abstract:

PROBLEM TO BE SOLVED: To obtain a chip-shaped magnetic sensor element which enhances a detection output by a method wherein a magnetism detecting film and a deviation electrode part are arranged inside the bonding face of a takeout substrate to a support substrate and both end faces of both substrates are provided with end-face electrodes which are connected electrically.

SOLUTION: First, a magnetism detecting film 2 and many electrode parts 3 are formed on a support substrate 1 directly by a vapor deposition operation or the like or by a transfer operation or the like. Then, a takeout substrate 4 whose size is nearly equal to that of the substrate 1 is bonded via a bonding layer 6 made of a thermosetting resin or the like in such a way that the detecting film 2 and the electrode parts 3 are sandwiched. After that, it is separated to be a rod shape by a dicing operation or the like in such a way that the electrode parts 3 are exposed to side faces. Then, side-face electrodes 7 are formed over both end faces of the substrate 1 and the substrate 4 by a printing operation, a dipping operation or the like, and they are connected electrically inside film-thickness faces of the electrode parts 3. After that, individual elements are separated by a dicing operation or the like. The thickness of a chip- shaped magnetic sensor element which is formed in this manner can be formed to be thin, and its detection output can be increased.





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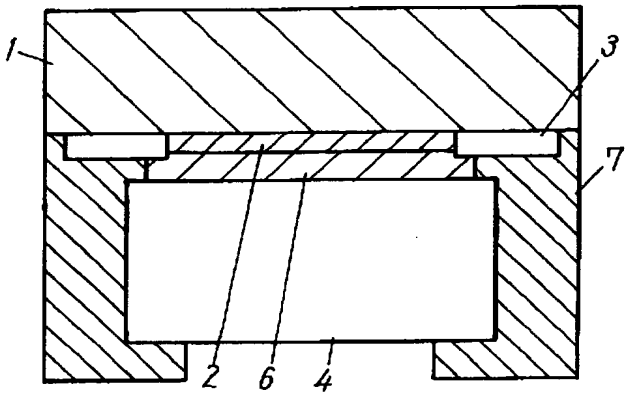
最終頁に続く

(54)【発明の名称】　チップ形磁気センサ素子及びその製造方法

(57)【要約】

【課題】　回転等の磁気検出器に用いられる磁気センサ素子において、磁気検出器の検出出力の向上を図ることを目的とするものである。

【解決手段】　取り出し基板４のその一方の面上に磁気検出膜２付き支持基板１を接合してなり、前記磁気検出膜２は前記取り出し基板４と前記支持基板１の接合面内に配置され、少なくとも前記取り出し基板４の両端面に前記引き出し電極部３と電気的に接続した側面電極７を備えて構成したものである。これにより、磁気検出膜及び磁気検出膜からの電気信号の取出しワイヤー、リードフレームを包み込むトランスファモールドを必要なく形成する事が出来、チップ形磁気センサ素子の厚みを薄く形成でき、磁気検出器の検出出力の向上を図ることが出来る。



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【特許請求の範囲】

【請求項１】　一方の面上に磁気検出膜を有すると共に当該磁気検出膜の引き出し電極部を有する支持基板と、上記支持基板に接合され、その接合部内に上記磁気検出膜を配設した取り出し基板と、少なくとも上記取り出し基板の両端面に設けられ、上記支持基板に設けた引き出し電極部に電気的に接続された側面電極を備えたチップ形磁気センサ素子。

【請求項２】　前記磁気検出膜を、支持基板に直接形成した請求項１記載のチップ形磁気センサ素子。

【請求項３】　前記磁気検出膜を、支持基板に転写形成した請求項１記載のチップ形磁気センサ素子。

【請求項４】　前記支持基板は、Ｓｉ、セラミックス、サファイア、フェライトより選択したいずれか１つを用いた請求項１記載のチップ形磁気センサ素子。

【請求項５】　前記取り出し基板は、セラミックス、フェライト、ガラス等の絶縁基板材料より選択したいずれか１つを用いた請求項１記載のチップ形磁気センサ素子。

【請求項６】　前記取り出し基板と前記支持基板とを同一材料で構成した請求項１記載のチップ形磁気センサ素子。

【請求項７】　前記側面電極は、互いに接合された前記取り出し基板と前記支持基板の両方の両端面に渡って設けられており、前記磁気検出膜から前記両端面に引き出された電極部の膜厚面内において電気的に接続した請求項１記載のチップ形磁気センサ素子。

【請求項８】　前記側面電極は、前記取り出し基板の前記引き出し電極部に対応する位置に配設した孔内に設けられた電極材を含み、上記引き出し電極部と電気的に接続されるように構成した請求項１記載のチップ形磁気センサ素子。

【請求項９】　支持基板上に磁気検出膜と前記磁気検出膜からの電気的信号を取り出す引き出し電極部を形成する工程と、前記支持基板に対し前記磁気検出膜の形成面を挟むように取り出し基板を接合する工程と、前記取り出し基板と前記支持基板の両方の両端面に渡って前記磁気検出膜から前記両端面に引き出された電極部の膜厚面内に電気的に接続するように側面電極を形成する工程を備えたチップ形磁気センサ素子の製造方法。

【請求項１０】　支持基板上に磁気検出膜と前記磁気検出膜からの電気的信号を取り出す引き出し電極部を形成する工程と、前記引き出し電極部に対応する位置に孔を配設した取り出し基板を前記支持基板に対し前記磁気検出膜の形成面を挟むように接合する工程と、前記引き出し電極部と電気的に接続されるように前記取り出し基板の孔内に電極材を設け上記取り出し基板の両端面にのみ側面電極を形成する工程を備えたチップ形磁気センサ素子の製造方法。

【発明の詳細な説明】

2

【０００１】

【発明の属する技術分野】本発明は、回転形等の磁気検出器に用いられるチップ形磁気センサ素子及びその製造方法に関するものである。

【０００２】

【従来の技術】半導体薄膜磁気センサ素子は、ＩｎＳｂ，ＩｎＳｂ－ＮｉＳｂ，ＩｎＡｓ等のキャリヤ移動度が高い半導体に対し、磁界を作用させたとき電圧の発生や抵抗値が変化するという性質を利用したものである。

【０００３】図４に一般的な半導体薄膜磁気センサ素子を用いた磁気検出器の構造を示す。３３は絶縁材よりなるコネクタブロックであり、このコネクタブロック３３はその一方の端部に機械的に固定されたバイアス用磁石３７と、前記バイアス用磁石３７に機械的に取り付けられた磁気センサ素子３８と、前記ホルダー３４に設けられた中継端子３６を介して前記磁気センサ素子３８が電気的に接続された回路部３５とを有する。そして、前記ホルダー３４のフランジ３２に機械的に固定され、これらの磁気センサ素子３８及び回路部３５等を保護するキャップ３１を有する構造となっている。

【０００４】前記キャップ３１の内部、磁気センサ素子３８の電気信号の取り出し構成を、さらに拡大した断面図を図５に示す。

【０００５】図４に示した磁気センサ素子３８はパッケージ化されて形成されており、図５に示すように支持基板４１上に磁気検出膜４２及び前記磁気検出膜４２から電気信号を取り出すために電極部４３が形成されており、リードフレーム４５に前記磁気検出膜４２と電極部４３が形成された支持基板４１がダイボンドされ、前記電極部４３からワイヤーボンディングのワイヤー４４を用い、リードフレーム４５に接続されると共に前記支持基板４１及びワイヤー４４、前記リードフレーム４５の一部を包み込むように樹脂４６でトランスファモールドされた構成である。そして、この磁気センサ素子３８はバイアス用磁石３７上に機械的に固定させている。

【０００６】また、磁気センサ素子３８とキャップ３１との間には、エアーギャップ（空間）４７が設けられ、キャップ３１の変形により前記磁気センサ素子３８内にある磁気検出膜４２に応力が加わった場合の応力歪みによる雑音の発生（今後、ピエゾノイズと呼ぶ）を防いでいる。

【０００７】次に一般的な磁気検出器の動作を図６に基づいて説明する。図６に示すように突起４９ａを持った回転する磁性体４９がキャップ３１の先端に近接すると、前記磁気センサ素子３８を挟んで前記バイアス用磁石３７との間に磁路を形成する。前記突起４９ａと前記バイアス用磁石３７との相対的な位置により前記磁気センサ素子３８に加わる磁束密度が変化するため、その変化が電気信号に変換され、前記回路部３５により処理されて出力信号として取り出される。

【０００８】

【発明が解決しようとする課題】前記した磁気検出器においては、前記磁性体４９と前記バイアス用磁石３７との距離が小さい程、大きな出力が得られる。ここで、距離は前記磁性体４９と前記キャップ３１間（第１の空間）、キャップ３１の厚み（第２の空間）、キャップ３１と前記パッケージされた磁気センサ素子３８とのエアーギャップ４７（第３の空間）、磁気センサ素子３８の厚みという４つの空間から構成されている。

【０００９】最近、ユーザより磁気検出器の取り付け領域の簡素化のため第１の空間である磁性体４９とキャップ３１と間の空間をさらに広げたい要望があり、このためには磁気検出器の検出出力を高めねばならない。検出出力を高めるためには、磁性体４９と前記バイアス用磁石３７とを極力近づける必要がある。また第２の空間から第４の空間を狭く構成する必要があるが、第２の空間はキャップ３１の厚みであり、強度の点であまり薄く出来ない。また第３の空間も同様にピエゾノイズ対策用エアーギャップ４７であり、あまり薄く出来ない。

【００１０】また、パッケージ化された磁気センサ素子３８の厚みを薄くする方法としては、磁気検出膜４２を形成している支持基板４１の基板厚を研磨等で薄く出来るが、基板の取り扱い等からあまり薄く出来ない。

【００１１】本発明は磁気検出器の検出出力の向上することを目的とするものである。

【００１２】

【課題を解決するための手段】この課題を解決するために本発明のチップ形磁気センサ素子は、取り出し基板のその一方の面上に磁気検出膜付き支持基板を接合してなり、前記磁気検出膜は前記取り出し基板と前記支持基板との接合面内に配置され、少なくとも前記取り出し基板の両端面に前記磁気検出膜からの引き出し電極部に電気的に接続した側面電極を備えたものである。

【００１３】これにより、磁気検出膜及び磁気検出膜からの電気信号の取出しワイヤー、リードフレームを包み込むトランスファモールドを形成する必要がなく、このためチップ形磁気センサ素子の厚みを薄く形成でき、磁気検出器の検出出力が向上するものである。

【００１４】

【発明の実施の形態】本発明の請求項１に記載の発明は、一方の面上に磁気検出膜を有すると共に当該磁気検出膜の引き出し電極部を有する支持基板と、上記支持基板に接合され、その接合部内に上記磁気検出膜を配設した取り出し基板と、少なくとも上記取り出し基板の両端面に設けられ、上記支持基板に設けた引き出し電極部に電気的に接続された側面電極を備えたチップ形磁気センサ素子であり、磁気検出膜及び磁気検出膜からの電気信号の取出しワイヤー、リードフレームを包み込むトランスファモールドを形成する必要がなく出来るため、センサ素子の厚みを薄く形成でき、磁気検出器の検出出力が向上するという作用を有するものである。



【００１５】本発明の請求項２に記載の発明は、前記磁気検出膜を支持基板に直接形成した請求項１記載のチップ形磁気センサ素子であり、磁気検出膜及び磁気検出膜からの電気信号の取出しワイヤー、リードフレームを包み込むトランスファモールドを形成する必要がなく出来るため、センサ素子の厚みを薄く形成でき、磁気検出器の検出出力が向上するという作用を有するものである。

【００１６】本発明の請求項３に記載の発明は、前記磁気検出膜を支持基板に転写形成した請求項１記載のチップ形磁気センサ素子であり、磁気検出膜及び磁気検出膜からの電気信号の取出しワイヤー、リードフレームを包み込むトランスファモールドを形成する必要がなく出来るため、センサ素子の厚みを薄く形成でき、磁気検出器の検出出力が向上するという作用を有するものである。

【００１７】本発明の請求項４に記載の発明は、支持基板をＳｉ、セラミックス、サファイア、フェライトより選択したいずれか１つを用いた請求項１記載のチップ形磁気センサ素子であり、支持基板として活用出来るという作用を有するものである。

【００１８】本発明の請求項５に記載の発明は、前記取り出し基板をセラミックス、フェライト、ガラス等の絶縁基板材料より選択したいずれか１つを用いた請求項１記載のチップ形磁気センサ素子であり、取り出し基板として活用出来るという作用を有するものである。

【００１９】本発明の請求項６に記載の発明は、前記取り出し基板と前記支持基板とを同一材料で構成した請求項１記載のチップ形磁気センサ素子であり、挟み込む材料を同一にする事で取り出し基板と支持基板の接合による膨張収縮差を無くし、前記基板間に挟み込まれた磁気検出膜への応力歪みを防止するという作用を有するものである。

【００２０】本発明の請求項７に記載の発明は、前記側面電極を互いに接合された前記取り出し基板と前記支持基板の両方の両端面に渡って設けており、前記磁気検出膜から前記両端面に引き出された電極の膜厚面内において電気的に接続した請求項１記載のチップ形磁気センサ素子であり、構成が簡単でリードレスのＳＭＤ実装が出来るという作用を有するものである。

【００２１】本発明の請求項８に記載の発明は、前記側面電極を前記取り出し基板の前記支持基板の前記引き出し電極に対応する位置に配設した孔内に設けられた電極材を含み、上記引き出し電極部と電気的に接続されるように構成した請求項１記載のチップ形磁気センサ素子であり、構成が簡単でリードレスのＳＭＤ実装が出来るという作用を有するものである。

【００２２】本発明の請求項９に記載の発明は、支持基板上に磁気検出膜と前記磁気検出膜からの電気的信号を取り出す引き出し電極部を形成する工程と、前記支持基板に対し前記磁気検出膜の形成面を挟むように取り出し

基板を接合する工程と、前記取り出し基板と前記支持基板の両方の両端面に渡って前記磁気検出膜から前記両端面に引き出された電極部の膜厚面内に電気的に接続するように側面電極を形成する工程を備えたチップ形磁気センサ素子の製造方法であり、多数の素子を同時に形成するウエハ等の一括処理でほとんど作成でき、しかも簡単な工程によりリードレスのＳＭＤ実装を可能とするという作用を有するものである。

【００２３】本発明の請求項１０に記載の発明は、支持基板上に磁気検出膜と前記磁気検出膜からの電気的信号を取り出す引き出し電極部を形成する工程と、前記引き出し電極部に対応する位置に孔を配設した取り出し基板を前記支持基板に対し前記磁気検出膜の形成面を挟むように接合する工程と、前記引き出し電極部と電気的に接続されるように前記取り出し基板の孔内に電極材を設け上記取り出し基板の両端面にのみ側面電極を形成する工程を備えたチップ形磁気センサ素子の製造方法であり、全工程多数の素子を同時に形成するウエハ等の一括処理で作成でき、しかも簡単な工程によりリードレスのＳＭＤ実装を可能とするという作用を有するものである。

【００２４】以下、本発明の実施の形態について図１から図３を用いて説明する。

（実施の形態１）図１は、本発明のチップ形磁気センサ素子の第１の実施形態を示す。図において、１はＳｉ、セラミックス、サファイア、フェライト等の支持基板、２はＩｎＳｂ，ＩｎＳｂ－ＮｉＳｂ，ＩｎＡｓ等のキャリヤ移動度が高い半導体、またはＮｉ－Ｃｏ，Ｎｉ－Ｆｅ，Ｎｉ－Ｆｅ－Ｃｏ等の強磁性体よりなる磁気検出膜であり、前記支持基板１上に蒸着等で直接または転写等で形成されている。３はＡｕ／Ｎｉ，Ａｌ／Ｃｒ，Ｃｕ／Ｔｉ，Ｃｕ／Ｃｒ，Ｉｎ，Ｐｂ等の材料よりなる前記磁気検出膜２からの電気信号の取り出し電極部であり、前記磁気検出膜２と同様に前記支持基板１上に蒸着等で前記支持基板１の両端まで形成されている。４はセラミックス、フェライト、ガラス等の絶縁材料よりなる取り出し基板であり、前記磁気検出膜２及び電極部３を挟み込むように前記支持基板１と接着層６を介して接合している。７は互いに接合された前記取り出し基板と前記支持基板の両方の両端面に渡って設けられた半田、Ｃｕ，Ｎｉ，Ａｇ，Ａｕ，Ｐｂ，Ｐｔ等の材料よりなる側面電極であり、前記磁気検出膜２から前記両端面に引き出された電極部３の膜厚面内において電気的に接続されている。

【００２５】尚、前記取り出し基板４と前記支持基板１とを同一材料で構成すると取り出し基板４と支持基板１の接合による膨張収縮差を無くし、前記基板間に挟み込まれた磁気検出膜２への応力歪みの無応力化が得られ、磁気特性感度が向上する。

【００２６】チップ形磁気センサ素子の作成方法は、蒸着等で直接または転写等で前記磁気検出膜２及び電極部３を多数個を支持基板１上に形成し、前記磁気検出膜２及び電極部３を多数個形成した支持基板１と同等程度の大きさの前記取り出し基板４を前記磁気検出膜２及び電極部３を挟み込むように前記支持基板１に、硬化性樹脂や異方性樹脂等の接着層６を介して接合する。その後、前記磁気検出膜２の両側に形成された電極部３が側面に表出するようにダイシング等で棒状に分離した後、前記支持基板１と取り出し基板４の両方の両端面に渡って、印刷、ディップ等で形成して前記磁気検出膜２から前記両端面に引出された電極部３の膜厚面内において電気的に接続される。その後、ダイシング等で個別素子に分離する。

【００２７】尚、個別分離は、前記支持基板１と取り出し基板４とを接合した後に行い、その後に側面電極をバレルめっき等で形成しても良い。

【００２８】また磁気検出膜２を形成した支持基板１の基板厚を研磨等でさらに薄くする工程は、支持基板１と前記取り出し基板４を接合した後に行うと、基板厚が取り出し基板をプラスした構造となるため、基板の取り扱いやソリが発生しにくく従来の支持基板より薄く研磨できる。

【００２９】本例で作成したチップ形磁気センサ素子は、従来のパッケージ化された磁気センサ素子に比べてモールド厚み分薄く形成することが出来ると共にさらに支持基板１も従来よりさらに薄く出来る。このため磁気検出器の検出出力が２０～３０％アップした結果が得られた。

【００３０】（実施の形態２）図２は、本発明のチップ形磁気センサ素子の第２の一実施形態を示す断面図である。図２において、１はＳｉ、セラミックス、サファイア、フェライト等の支持基板、２はＩｎＳｂ，ＩｎＳｂ－ＮｉＳｂ，ＩｎＡｓ等のキャリヤ移動度が高い半導体、またはＮｉ－Ｃｏ，Ｎｉ－Ｆｅ，Ｎｉ－Ｆｅ－Ｃｏ等の強磁性体よりなる磁気検出膜であり、前記支持基板１上に蒸着等で直接または転写等で形成されている。３はＡｕ／Ｎｉ，Ａｌ／Ｃｒ，Ｃｕ／Ｔｉ，Ｃｕ／Ｃｒ，Ｉｎ，Ｐｂ等の材料よりなる前記磁気検出膜２からの電気信号の取り出し電極部であり、前記磁気検出膜２と同様に前記支持基板１上に蒸着等で前記支持基板１の両端または両端手前まで形成されている。４はセラミックス、フェライト、ガラス等の絶縁材料よりなる取り出し基板であり、前記磁気検出膜２及び電極部３を挟み込むように前記支持基板１と接着層６を介して接合している。

【００３１】前記取り出し基板４には、前記支持基板１上に形成された前記磁気検出膜２からの電気信号の取り出し電極部３の両側に対応する位置に配設した孔が設けられている。

【００３２】尚、前記取り出し基板４と前記支持基板１とを同一材料で構成すると取り出し基板４と支持基板１

の接合による膨張収縮差を無くし、前記基板間に挟み込まれた磁気検出膜２への応力歪みの無応力化が得られ、磁気特性感度が向上する。

【００３３】７は前記取り出し基板４の孔内に設けられた半田、Ｃｕ，Ｎｉ，Ａｇ，Ａｕ，Ｐｂ，Ｐｔ等の材料よりなる側面電極であり、前記支持基板１上に形成された前記磁気検出膜２からの電気信号の取り出し電極部３に電気的に接続されている。

【００３４】第２の実施形態のチップ形磁気センサ素子の作成方法は、蒸着等で直接または転写等で前記磁気検出膜２及び電極部３を多数個を支持基板１上に形成し、前記磁気検出膜２及び電極部３を多数個形成した支持基板１と同等程度の大きさの前記取り出し基板４を前記磁気検出膜２及び電極部３を挟み込むように前記支持基板１に硬化性樹脂や異方性樹脂等の接着層６を介して接合する。

【００３５】前記取り出し基板４は、上記したように前記支持基板１上に形成された前記磁気検出膜２からの電気信号の取り出し電極部３の両側に対応する位置に配設した孔を前記支持基板１同様に多数設けている。前記孔は隣接素子の取り出し孔と兼ねて形成しても良く、兼ねることで素子サイズが小さく出来る利点がある。

【００３６】その後、前記取り出し基板４に形成した孔に印刷、ディスペンサ等の注入などで側面電極７を形成して前記支持基板１上に形成された前記磁気検出膜２からの電気信号の取り出し電極部３に電気的に接続する。その後、今まで一括処理して多数形成された素子を個別にダイシング等により分離する。

【００３７】（実施の形態３）図３に示す様に前記孔付き取り出し基板４の孔内にあらかじめ側面電極７の下地電極５を設けておけば側面電極７形成が簡略化され、側面電極７は孔内全部を埋める必要が無く電極部３及び下＊



＊地電極５に形成すれば良い。

【００３８】また、磁気検出膜２を形成した支持基板１の基板厚を研磨等でさらに薄くする工程は、支持基板１と前記取り出し基板４を接合した後に行うと、基板厚が取り出し基板をプラスした構造となるため、基板の取り扱いやソリが発生しにくく従来の支持基板より薄く研磨できる。

【００３９】

【発明の効果】本発明のチップ形磁気センサ素子は、従来のパッケージ化された磁気センサ素子に比べてモールド厚み分薄く形成することが出来ると共にさらに支持基板１も従来よりさらに薄く出来る。このため、磁気検出器の検出出力が２０～３０％アップした結果が得られた。

【図面の簡単な説明】

【図１】本発明のチップ形磁気センサ素子の第１の実施形態を示す断面図

【図２】本発明のチップ形磁気センサ素子の第２の実施形態を示す断面図

【図３】本発明のチップ形磁気センサ素子の第３の実施形態を示す断面図

【図４】従来の磁気検出器の断面図

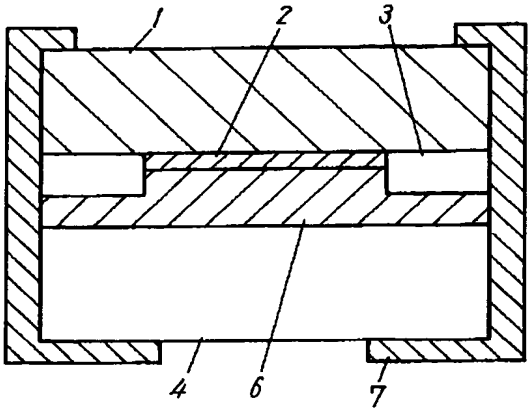
【図５】同磁気検出器のキャップ内の拡大断面図

【図６】同磁気検出器の動作説明のための側面図

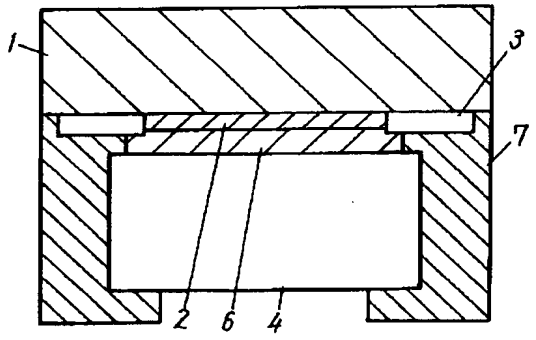
【符号の説明】

1　支持基板
2　磁気検出膜
3　電極部
4　取り出し基板
6　接着層
7　側面電極

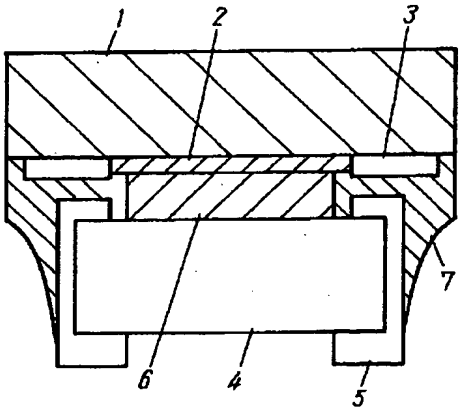
【図１】



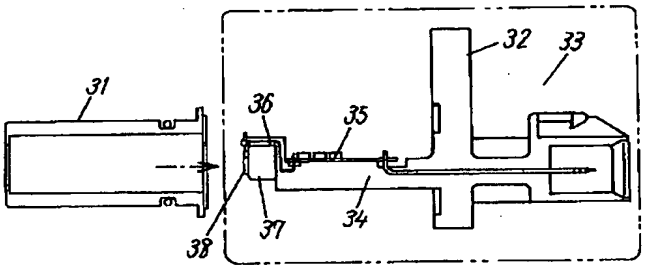

【図２】



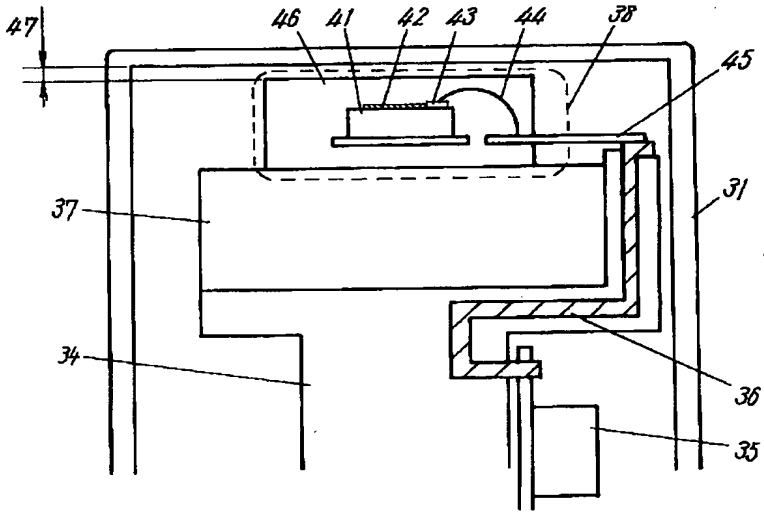
【図３】



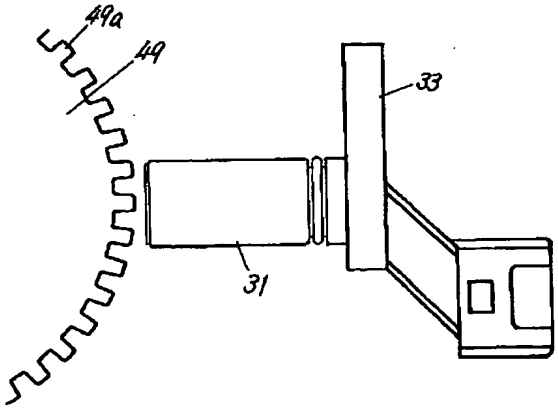

【図４】




【図５】




【図６】

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